therapy. Biochemical failure (after receiving both EBRT and/or BQT) was based on Phoenix definition. Acute and late genitourinary and gastrointestinal toxicities were documented based on Common Terminology Criteria for Adverse Events (v4.0). Median follow-up after HDRB was 36 months (7-109 months).
Results: At the time of the study the 3-year biochemical relapse-free rate was 58% (74-42, 95% CI). Local relapse was 13% (23-3, 95% CI). 3-year systemic relapse rate was 7'4% (8'12-7'04, 95% CI) and the 3-year overall survival rate was 91% (101-81, 95% CI). Late genitourinary Grade 3 and 4 were 8'3% and 3'3%, respectively. Nine patients required urinary catheter, 5 patients required transurethral resection and 2 pts required suprapubic cistostomy. No Grade 3 or 4 rectal toxicity were observed in our study.
Conclusions: Salvage prostate HDRB is an effective modality for locally recurrent cancer after EBRT with an acceptable late genitourinary toxicity of 8'3%.

Proffered Papers: Brachytherapy 3: Physics - Treatment planning

OC-0091

Multidimensional dosimetric characterization of 106Ru applicators for brachytherapy of uveal melanoma

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Purpose/Objective: The dosimetry of 106Ru plaques typically relies on one-dimensional dose measurements on the central axis of the brachytherapy source. However, to better characterize the dosimetric properties and for comprehensive quality assurance of different applicator models multidimensional measurements are necessary, which in turn can be used for treatment planning. In this study radiochromic film measurements were performed in multiple planes and benchmarked with Monte Carlo (MC) simulations, micro-diamond and diode measurements in terms of absolute dose rates and relative dose distributions.
Materials and Methods: Using EBT3 films 2D dose distributions of three different applicator models (CCA, CCB and COB) were measured parallel to the central axis as well as on normal planes in a purpose-built and in-house developed polystyrene phantom. Source non-uniformity was evaluated in-air using films in a simple setup. All applicators were modeled using the MCNP6 MC code. Reference dose rates and dose distributions of MC and films were validated against BEBIG values and micro-diamond and diode measurements performed in a water-scanning phantom. The benchmarked dose distributions were superimposed on representative tumor geometries of a broad range of clinical target sizes. The respective dosimetric margins were determined for a given combination of target and applicator size in order to assess the applicator types in terms of their limits concerning tumor coverage and tumor volume.
Results: The agreement of absolute dose rates at a reference depth of 2 mm on the central axis of the applicator was better than 5 % comparing film measurements with respect to the manufacturer's data. The source non-uniformity evaluation yielded values < 10 %. The MC absolute dose rates showed larger deviations with up to 10 % deviations from film results. These high differences were close to the plaque's surface but quickly vanished for depths > 2-3 mm, depending on the applicator model. For the depth-dose profiles the measurements yielded a reproducibility (1 SD) < 4 % for all investigated applicator types and all detectors. A comparison of measured and calculated data using local γ-index criteria of 1 mm/5 % showed pass rates > 94 %. Tumor coverage was evaluated regarding the dose prescribed to the tumor apex. It was found that for a majority of cases the tumor volume is either not sufficiently covered by the 100 % prescription isodose or does not provide a margin to allow for dosimetric uncertainties if the difference between applicator diameter and basal diameter ≤ 4 mm.
Conclusions: Multidimensional film dosimetry for 106Ru eye applications was successfully established and validated against MC calculations as well as other experimental methods. Both absolute and relative dose measurements were well within the tolerances given by the manufacturer. The multidimensional dosimetric information can be utilized in treatment planning.

OC-0092

DVH-based inverse planning of prostate HDR brachytherapy by simulated annealing rapidly gives good solutions

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Purpose/Objective: Inverse planning software for HDR brachytherapy currently used in hospitals employ dose-based penalty functions. The resulting treatment plans may require manual a posteriori adjustments to meet clinical criteria. As treatment plans are changed intraoperatively after catheter insertion, computation speed is a relevant criterion. Therefore, new algorithms need to be developed that directly and rapidly optimize clinically relevant dose-volume histogram (DVH)-criteria. These algorithms rely on expensive general purpose solvers. In this work, we propose a local search algorithm, DVH-Optimization by Pure Simulated Annealing (DOPSA), which is independent of cost-intensive general purpose solvers, directly optimizes for clinically relevant criteria, and provides high-quality treatment plans within seconds.
Materials and Methods: We have devised a simulated annealing-based local search algorithm that maximizes the prostate volume receiving the prescribed dose, $V_{100\%}$, while strictly complying to imposed DVH-constraints, $D_{10\%}$ and D_{max}, on rectum and urethra. The algorithm's architecture allows extensions to more constraints. The computationally most constraining step is addressed by efficient large-scale sparse matrix multiplication. Constraint satisfaction is parsimoniously evaluated and neighborhood searches dynamically adjust to local search space characteristics. The algorithm is compared to two existing DVH-based inverse planning solutions, IPIP by Siauw et al.(2011) and MILP by Gorissen et al. (2013), using data of three patients.
Results: Any solution by the algorithm provides a treatment plan which conforms to the imposed DVH-criteria. Based on the available data of three patients, the proposed algorithm displays advantages over both alternative optimizers: DOPSA consistently outperforms IPIP in plan quality at negligible differences in speed. MILP takes considerably longer to provide plans of comparable quality but, given sufficient